

Experimental Economics on Firm's Behavior: Entry Game Approach

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ABSTRACT

The paper analyzes subject's behavior in evolutionary process of entry game. The experiment is designed to analyze the behavior of the subject. The experiment is set in sequential entry games. Process of the game was conducted under asymmetric information, uncertainty, payoff perturbation and random matching. The subjects of the experiment were students of the Universitas Udayana, Bali, Indonesia. Subjects who play as new-entrance firms tend to choose "stay-out" strategy when the uncertainty and the amount of loss increase. Meanwhile, the subjects who play as an incumbent firm, which set to have more information about the game (market) rather than the new-entrances, most of the time abuse their position by choose "threat" strategy, which not a credible strategy for some of them. Experimental studies shows that New-entrance tend to weight more on lost when the risk increase (from risk averse setting to risk seeking setting), and tend to choose sure value over a lotteries although the expected value from lotteries is higher or the same. These findings support the reason that Indonesian youngsters tend to choose a job as a PNS or employee of existing firms. The results also support the reason that Indonesian businessman is more willing to open a new business if they have a guarantee for their losses.

Keywords: entry Game, experiment, asymmetry information, lost aversion

Ekonomi Eksperimental Perilaku Perusahaan: Pendekatan *Entry Game*

ABSTRAK

Makalah ini menganalisis perilaku subjek dalam proses evolusi *entry game* dengan menggunakan pendekatan eksperimen. Eksperimen diatur dalam *entry game* yang berurutan. Proses permainan ini dilakukan di bawah informasi asimetris, ketidakpastian, *payoff perturbation* dan *random matching*. Subyek yang digunakan dalam penelitian adalah mahasiswa Universitas Udayana, Bali, Indonesia. Subyek yang bermain sebagai perusahaan *new-entrance* cenderung memilih strategi "stay-out" saat ketidakpastian dan kerugian meningkat. Sementara itu, subyek yang bermain sebagai perusahaan *incumbent*, yang diatur untuk memiliki informasi lebih tentang permainan (pasar) daripada *new-entrance*, sering kali menyalahgunakan posisi mereka dengan memilih strategi "threat", yang sebenarnya bukan strategi yang kredibel untuk beberapa dari mereka. Hasil eksperimen menunjukkan bahwa *new-entrance* cenderung lebih berat pada *lost* ketika resiko meningkat (dari seting *risk averse* ke seting *risk seeking*), dan cenderung memilih nilai yang pasti daripada lotere meskipun *expected value* dari lotere lebih tinggi atau paling tidak sama. Temuan ini mendukung alasan bahwa pemuda Indonesia cenderung memilih pekerjaan sebagai PNS atau karyawan perusahaan dibandingkan dengan membuka bisnis baru. Hasil ini juga mendukung alasan bahwa pengusaha Indonesia lebih bersedia untuk membuka bisnis baru jika mereka memiliki jaminan atas kerugian mereka.

Kata kunci: entry game, eksperimen, informasi asimetris, lost aversion

INTRODUCTION

Industrialization in Indonesia has been started since the early age of this country. Many strategies have been used to improve the outcomes of the industry, some works, but some many did not.

Nowadays, Indonesian Industrialization seem left behind compare to the other countries that started their industrialization barely in the same time with Indonesia, Malaysia for example. Indonesia employed protective policies toward new industries in the past, in order to protect the infant industry, and give them

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opportunity to prepare their technologies to compete in the future at wider market. Many countries did this policy and prevail to improve their industries, but not with Indonesia. Many Indonesian firms, which enjoy the protection, fail to improve their technology and value added. Today, many of Indonesian big firms still engage in basic industry, which exploit the natural resources. Indonesian main export commodity still filled with basic products.

Indonesian statistic bureau (BPS) data stated, during 2001-2010, number of big and medium industry in Indonesia is less than 1 percent. During that period, Indonesian industries mostly engage in small industry, which absorb no less than 60 percent of labor force, but the proportion of their national value added only reach 22 percent. Small Medium Enterprises (SMEs) policy seems work to support the national economy during the financial crisis, only in terms of labor absorption, but not in terms of improve the value added of the nation. Indonesian youngsters, who just enter the job market, seems to hesitate open a new business. Indonesian youngsters are more willing to work as Government Officer (PNS) or employee of existing firms.

Nowadays, many firms in Indonesia engage with corruption in the government project. The firms usually bribe the government officer to wins some project. In developing countries, which government project is abundant, it is seems to be more profitable enter the government project business than to compete in international market. These are the dark facades of Indonesian industry which too important to be ignored.

Possible Explanations for Industry Failure

There are several possible explanations for industry failure in Indonesia. Datta and Mullainathan (20012) suggest using behavioral science to help explain and design development programs or policies. In this paper we attempt to explain the failure from entry-game viewpoint. This paper investigates the preference of economic agent using experiment on entry-game. At least, there are two explanations can be derive from entry-game. First, the behavior concerning about new-entrance choices, which most of the time involve asymmetry information about the market. Asymmetry information implies uncertainty about market outcomes, which make the new-entrance choices involve risk. Choices involving risk has two kind of behavior; risk-averse and risk seeking. Indonesian youngsters who more favor become PNS or employee of existing firms may reflect risk-averse behavior. Meanwhile, businessmen who engage with

corruption may reflect risk-seeking behavior. Risk-seeking behavior may also showed by people who overconfidence enter the market, Camerer and Lovo (1999) investigates this behavior to explain the high rate of business failure.

Second, the behavior concerning about incumbent choices, which has more information about the market. In the concept of sub-game perfection, first introduced by Nobel Prize winner Reinhard Selten (1978), an incumbent who has not credible strategy still has an opportunity to threat the new entrance to enter the market. The threat, whether it is credible or not, is a form of anticompetitive strategy. The success story of Bangladesh garment industry, as stated by Easterly (2001), tells us that technology and information about market leaks within an industry. New entrance does not feel threaten by incumbent in the industry because all of the information about market has already transferred. Asymmetry information in the entry game gives the incumbent a favorable position to exploit the market.

METODOLOGY AND DATA

Experimental Design: The Players and Strategies

In order to test our argument on possible explanations for industry failure in Indonesia we design a sequential entry-game played by 24 students from Faculty of Economics and Business, Udayana University - Bali. The reason of using students instead of real player (real businessman) in this research is because this research focuses to reveal the behavior or attitude of the agent, which expressed in the form of preference. Based on Rubinstein (2012), preference and choice are treated independently. We often use the concept of preferences not in the context of choice. Rubinstein (2012) mention some examples; we talk about an individual's tastes over the paintings of the masters even if he never makes a decision based on those preferences. We refer to the preferences of an agent were he to arrive tomorrow on Mars or travel back in time and become King David even if he does not believe in the supernatural. This research also do the same thing, we observes the student's preferences in conducting an entry-game, which illustrate the businessman's behavior, even if they never make these decisions in their real life.

Random-matching games, like discussed in Ellison (1994) and Okuno-Fujiwara and Postlewaite (1995), leads us to an idea of randomization. The aim of randomization is to illustrate businessman's behavior in dealing with their random partner or rival. In their

Table 1. Random Matching and The Distribution of LP Type 2 Among Incumbents

		Game																
		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	#16	
New Entrance	Incumbent																	
	1	3	7	1	4	8	11	11	6	12	11	10	3	11	6	9	7	
	2	11	3	5	5	10	4	5	2	2	12	1	11	4	8	3	11	
	3	6	2	7	1	12	10	6	4	7	4	3	2	9	1	11	4	
	4	12	9	9	12	1	3	3	3	9	8	7	7	1	12	2	9	
	5	4	8	2	10	3	5	8	10	8	3	11	10	12	5	6	3	
	6	10	1	8	9	7	9	1	8	6	6	5	6	6	4	1	10	
	7	2	4	10	6	11	8	10	11	11	5	6	5	5	7	10	6	
	8	1	6	12	8	6	2	2	9	3	1	12	8	7	2	4	5	
	9	7	5	4	7	2	6	12	12	4	10	9	4	10	10	5	12	
	10	8	10	6	2	9	7	7	1	5	9	4	9	8	9	7	8	
	11	9	11	11	3	4	1	4	5	1	7	8	1	2	3	8	1	
12	5	12	3	11	5	12	9	7	10	2	2	12	3	11	12	2		

Note: shaded cells represent incumbent who has LP type 2.

Table 2. Pay-off Design for New-entrance Risky Behavior

		Risky Behavior		
		Risk Averse	Risk Seeking (o)	Risk Seeking (-)
Incentives/disincentives to Enter				
Small	Gain>loss	Game 5		Game 16
	Gain<loss	Game 6		Game 1
	Gain=loss		Game 8	
Big	Gain>loss	Game 7, and 14	Game 3	Game 2, and 12
	Gain<loss	Game 4, and 11	Game 10	Game 9, and 15
	Gain=loss		Game 13	
Incentive to Stay-out				
	IDR 0	Game 5, 6, 11, and 14	Game 8, and 13	Game 1, 2, 15, and 16
	IDR 20,000	Game 4, and 7	Game 3, and 10	Game 9, and 12

life span, businessman may not always engage with the same rival, instead they match in random way. Because of that, the students then separated into two groups; incumbent and new-entrance, the selection is conducted randomly. Players order is also selected in random way. In order to fulfill fairness principle, the game is played twice. In the second game the player switch their position, and the order reshuffled once again.

Each of players in this game has two kinds of strategies. New-entrance has “stay-out” and “enter” and incumbent has “High Price (HP)” and “Low Price (LP)” strategies. Incumbent has a special feature on their “LP” strategy; it is involve asymmetry information. New-entrance cannot observe whether incumbent has LP type 1 or type 2 exactly, but only the proportion of these types among the incumbents. Un-credible incumbent have LP type 1 and credible incumbent have LP type 2. The distribution of LP type 2 among incumbents shown in Table 1. This feature

puts new-entrance in a risky decision. The game and the illustration in this research are adapted from Pepall, *et. al* (2008), see also Osborne (2003) for another version of illustration.

The Pay-off

Pay-off is design to investigates preferences regarding lotteries. The expected value of the payoff is presented as von Neumann and Morgenstern (1944) expected faction. Decision under risk described using several combinations in the pay-off matrix composition. Following Kahneman and Tversky (2000) we define the risk-averse behavior as an acceptance for a certain amount of money against a lotteries for some money, which has a higher expected value, and an acceptance for winning a money from a lotteries, which has lower or at least the same expected value, against a certain amount of money defined as risk-seeking. The value between the certain value and the lotteries value is IDR 5,000,- for risk averse and minus IDR 5,000,-

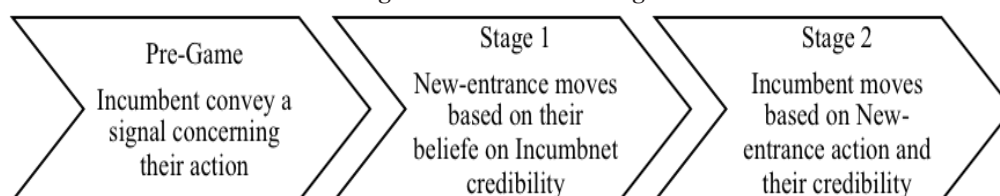
Table 3. Samples of Pay-off Matrix Face by Incumbents

Game 1 ; 50% incumbent credible					
	HP		LP type 1		
Enter	New Entrance	Rp 20,000	New Entrance	Rp20,000	
	Incumbent	Rp 80,000	Incumbent	Rp 60,000	
Stay-Out	New Entrance	Rp 0	New Entrance	Rp 0	
	Incumbent	Rp 130,000	Incumbent	Rp 100,000	

Game 2 ; 75% incumbent credible					
	HP		LP type 2		
Enter	New Entrance	Rp 220,000	New Entrance	-Rp80,000	
	Incumbent	Rp 80,000	Incumbent	Rp 150,000	
Stay-Out	New Entrance	Rp 0	New Entrance	Rp 0	
	Incumbent	Rp 130,000	Incumbent	Rp 200,000	

Note: shaded cells represent incumbent's outcome over a strategy he make.

Figure 1. The Game's Stages



or zero for risk –seeking. The procedure used in this research is different compare to previous researches in risky choices, like compiled in Kahneman and Tversky (2000). This research use direct interaction with the event in game to examine the subject's behavior instead of list of questionnaire without direct interaction with an event. Table 2 describes the design for pay-off matrix, concerning about risky behavior and its position in the game.

This research also try to investigates subject's behavior concerning about lost and gain. As depict in Table 2, we set two kinds of incentive; small (get gain of IDR 15,000.- to IDR 25,000.-) and big (get gain of IDR 80,000.- to 250,000.-), and also two kinds of disincentive; small (get loss of IDR 10,000.- to IDR 30,000.-) and big (get loss of IDR 50,000.- to 270,000.-). This formulation is inspired by Kahneman and Tversky (1984). The aim of this formulation is to investigate the behavior that motivates the players to enter the market, the perspective toward loss or gain. See Appendix 3 for the pay-off matrix of the entire game.

Following Pradiptyo *et.al.* (2011), this paper uses pay-off changing procedure in order to see the response of the players toward each incentive. New-entrance's outcome is affected the most in this procedure, meanwhile incumbent's outcome only changing between LP type 1's outcome and LP type 2's outcome. Table 3 shows two examples of the

incumbent's outcome changing.

Beside the pay-off changing procedure, this research also provides the history of the previous game, which may use as information that shows the reputation of the counterpart. However, as stated by Takahashi (2010) about first-order information, records of counterpart's past information are not always observable due to various restrictions or limitations.

The Game's Stages

Entry game that we use in this research is a dynamic game between two firms, one a giant firm called Incumbent and an upstart firm called New-entrance, which wish to enter the market. The game has two stages and Figure 1 shows the description of the stages.

Stage 1: New-entrance choosing either to enter Incumbent's market or stays out. If New-entrance stays out it earns a normal profit from being somewhere else in the economy, which is IDR 0,- in some games or IDR 20,000,- in some other games (see Table 1). If New-entrance enter, he probably earns some money or loose it, it depends on Incumbent's credibility. The choice is made after processing the information about the proportion of credible incumbent in the market, which is 75%, 50%, or 25%. The higher proportion of the credible Incumbent, the higher possibility to loose some money, if New-entrance enters the market.

Stage 2: Incumbent choosing either to fight the New-entrance's action by choosing LP or accommodates

Table 4. Lists of Enter and Stay-out in Risk-averse Setting

	Incentive/disincentive to Enter	Probability to win some money	Amount for Stay-out	Enter	Stay-out
Small	Gain>loss	50%	IDR0.-	20 [83.33%]	4 [16.67%]
	Gain<loss	75%	IDR0.-	20 [83.33%]	4 [16.67%]
Big	Gain>loss	25%	IDR20,000.-	7 [29.17%]	17 [70.83%]
		50%	IDR0.-	23 [95.83]	1 [4.17%]
	Gain<loss	75%	IDR20,000.-	4 [16.67%]	20 [83.33%]
		75%	IDR0.-	17 [70.83%]	7 [29.17%]
		Total		91 [63.19%]	53 [36.81%]

it by choosing HP. The LP strategy does not always specify the fight action, LP. Instead, it should be viewed as specifying two different actions depending on whether New-entrance enters and their own credibility. For credible Incumbent the LP strategy is always a dominant strategy. But for un-credible Incumbent the LP strategy may use as a threat to keep New-entrance out. There is also a dilemma for un-credible Incumbent if New-entrance does not enter the market; the strategy says that the un-credible Incumbent should not execute his LP strategy, but switch to execute HP (accommodate the entrance).

RESULTS

Behavior Toward Opening a New Business in Risk Averse Setting

Table 4 lists the number of New-entrance enter or stay-out in risk-averse setting. In general, 63.19 percent New-entrance enter the market and 36.81 percent stay-out. This result shows most of New-entrance favor to enter the market, they prefer lotteries, which involve loose and gain, to a certain circumstances.

In “small” incentive/disincentive risk-averse setting we try to capture subject’s behavior, especially for the youngster behavior toward opening a small medium enterprise (SME). The zero amounts for stay out describe the situation that the youngster is a fresh graduate. We can summarize this behavior using the frame like in Kahneman and Tversky (1984).

Game 5. N = 24; choose between

A. a sure get IDR 0.- [16.67%]

B. 50% change to win IDR 20,000.- or 50% change to lose IDR 10,000.- [83.33%]

Game 6. N =24; choose between

C. a sure get IDR 0.- [16.67%]

D. 75% change to win IDR 15,000.- or 25% change to lose IDR 25,000.- [83.33%]

In these two settings most of New-entrance willing to enter the market, although in Game 6 the amount of loss is greater than gain.

The same behavior also appears in “big” incentive/disincentive, the numbers of New-entrance that enter the market are larger than stay-out. The following pair of problems taken from Game 14 and 11 describes the behavior of youngster in opening a big business.

Game 14. N=24; choose between

E. a sure get IDR 0.- [4.17%]

F. 50% change to win IDR 150,000.- or 50% change to lose IDR 140,000.- [95.83%]

Game 11. N =24; choose between

G. a sure get IDR 0.- [29.17%]

H. 75% change to win IDR 80,000.- or 25% change to lose IDR 220,000.- [70.83%]

When the business setting change to “big” most of New-entrance favor to enter the market, 95.83% subject chose enter. But, there is a little difference behavior in these two games especially when we compare Game 6 and Game 11. When the amount of loss relatively high, like in Game 11, the numbers of enters decrease to 70.83 percent, meanwhile, numbers of entrance in Game 6 remain unchanged. This finding shows that the subject changes their weight in evaluating loss. When the loss is relatively low, like in Game 6, subject tend to weight loss lower, but when the loss is relatively high, like in Game 11, the New-entrance change their weight toward loss. This finding supports the prospect theory by Tversky and Kahneman (1979). The lost aversion behavior looks more obvious in the next setting.

Game 7. N=24; choose between

I. a sure get IDR 20,000.- [70.83%]

J. 25% change to win IDR 250,000.- or 75% change to lose IDR 50,000.- [29.17%]

Game 4. N =24; choose between

K. a sure get IDR 20,000.- [83.33%]

L. 75% change to win IDR 120,000.- or 25% change to lose IDR 260,000.- [16.67%]

In these setting, most of New-entrance tend to stay out, both in relatively low lost and high lost. These findings support the reason that Indonesian youngster more favor to works as PNS or as an employee of

Table 5. Lists of Enter and Stay-out in Risk Seeking Setting (Negative Expected Value)

Incentive/disincentive to Enter		Probability to win some money	Amount for Stay-out	Enter	Stay-out
Small	Gain>loss	25%	IDRo.-	16 [66.67%]	8 [33.33]
	Gain<loss	50%	IDRo.-	13 [54.17%]	11 [45.83%]
Big	Gain>loss	25%	IDRo.-	17 [70.83]	7 [29.17%]
		25%	IDR20,000.-	16 [66.67%]	8 [33.33%]
	Gain<loss	75%	IDR20,000.-	11 [45.83%]	13 [54.17%]
		50%	IDRo.-	11[45.83%]	13 [54.17%]
	Total			84 [58.33%]	60 [41.67%]

Table 6. Lists of Enter and Stay-out in Risk Seeking Setting (Zero Expected Value)

Incentive/disincentive to Enter		Probability to win some money	Amount for Stay-out	Enter	Stay-out
Small	Gain=loss	50%	IDRo	17 [70.83%]	7 [29.17%]
Big	Gain>loss	25%	IDR20,000	7 [29.17%]	17 [70.83%]
	Gain<loss	75%	IDR20,000	16 [66.67%]	8 [33.33%]
	Gain=loss	50%	IDRo	16 [66.67%]	8 [33.33%]
	Total			56 [58.33%]	40 [41.67%]

existing firms. Although the setting is under risk-averse setting, which the expected value of lotteries (enter) is bigger than stay-out, the subjects are more favor to chose stay-out.

Behavior Toward Opening a New Business in Risk Seeking Setting

Table 5 and 6 lists the number of New-entrance enter or stay-out in risk-averse setting. In general, both in negative and zero expected setting, 58.33 percent New-entrance enter the market.

When the setting change from risk-averse to risk seeking, we find the phenomena that appear in the “big” incentive/disincentive in risk-averse setting, appear in “small” incentive/disincentive. In “small” incentive/disincentive risk-seeking setting, we find that subject tend to change their weight about loss, which we does not find in “small” incentive/disincentive in risk-averse setting. The number of entrance decrease from 66.67 percent in Game 16 (Gain>loss) to 54.17 percent in Game 1 (Gain<Loss). This finding shows us that in risky circumstance the subject tend to more responsive toward loss.

In “big” incentive/disincentive setting we also find the same behavior as what we discovered in the risk-averse setting, which support the reason that Indonesian youngster more favor to works as PNS or as an employee of existing firms. The problems in Game 2 and 12 may set in following choices.

Game 2. N=24; choose between

M. a sure get IDR 0.- [29.17%]

N. 25% change to win IDR 220,000.- or 75% change to lose IDR 80,000.- [70.83%]

Game 12. N =24; choose between

O. a sure get IDR 20,000.- [33.33%]

P. 25% change to win IDR 240,000.- or 75% change to lose IDR 60,000.- [66.67%]

In this settings the number of entrance decrease from 70.83 percent in Game 2's setting to 66.67% in Game 12's setting. Although the amount of expected value from these two problems are the same (minus IDR 5,000.-), subject tend to respond to the sure amount of money that offer by the stay-out circumstance.

Behavior Toward Threat and Credibility

Table 7 lists the number of Incumbent's strategy and their action toward the New-entrance action. This setting is use to explain the existence of threat in Incumbent's behavior. In this game, there are 384 Incumbent, which divided into 180 credible Incumbent (46.88 percent) and 204 un-credible incumbent (53.13 percent). Table 7 shows that 92.22 percent credible incumbent chose strategy LP and executes them into action. This result is obvious because LP is a rational choice for credible Incumbent. Just only a small numbers of credible Incumbent choose HP. This finding also supports Pradiptyo, *et.al* (2011), which shows that Indonesian is a homo economicus.

Table 7 shows that 85.29 percent of un-credible Incumbent chose LP in pre-game, or in other word, we can say that the un-credible incumbents try to threat the New-entrance. But, when the New-entrance chose their action, ether to enter or stay out all these un-credible Incumbent change their action. From the sub-game perfection viewpoint this result is rational, because LP is not a strategy that involve

Table 7. Incumbent's Strategy and Action

Game	Credible Incumbent		Un-credible Incumbent		
	Number	Chose LP	Number	Chose LP in Pre-Game	Execute to HP
1	12	10	12	6	6
2	18	16	6	4	4
3	18	18	6	6	6
4	6	6	18	14	14
5	12	8	12	8	8
6	6	6	18	12	12
7	18	18	6	6	6
8	12	10	12	12	12
9	6	6	18	18	18
10	6	6	18	16	16
11	6	6	18	16	16
12	6	6	18	18	18
13	12	12	12	12	12
14	12	12	12	12	12
15	12	12	12	10	10
16	18	14	6	4	4
Total	180	166	204	174	174
	46.88%	92.22%	53.13%	85.29%	100%

sub-game perfection for the un-credible Incumbent. From another viewpoint, this phenomenon depicts the existence of time inconsistency in Incumbent preference. See, Kydland and Prescott (1977) for discussion of time inconsistency.

CONCLUSION

This experimental result shed some light for a discussion about policy in developed Indonesian industries. Experimental studies shows that New-entrance tend to weight more on lost when the risk increase (from risk averse setting to risk seeking setting), and tend to choose sure value over a lotteries although the expected value from lotteries is higher or the same. These findings support the reason that Indonesian youngsters tend to choose a job as a PNS or employee of existing firms. The results also support the reason that Indonesian businessman is more willing to open a new business if they have a guarantee for their losses. These findings suggest us to set an insurance policy for SME or big firms rather than protection policy like what was applied in Indonesia

in the past. Protection policy is obviously fail because of the behavior of Indonesian businessman that tend to abuse their dominant position over New-entrance, like what we finds in threat behavior in Incumbent's behavior.

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